Nov. 26, 1963 W. PFERD ETAL 3,112,147

INSULATION CRUSHING SOLID WIRE CLIP TERMINAL

Filed March 26, 1962

FIG. 1

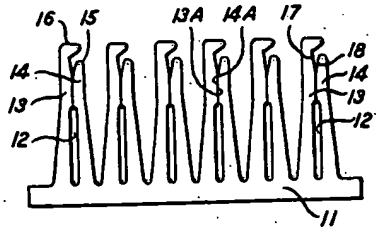


FIG. 2

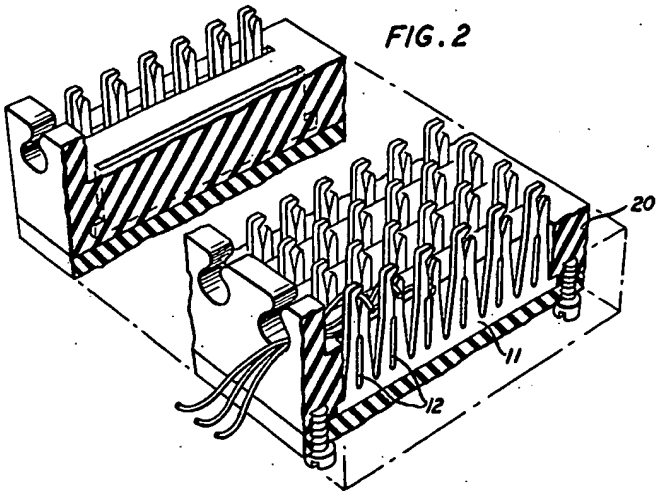
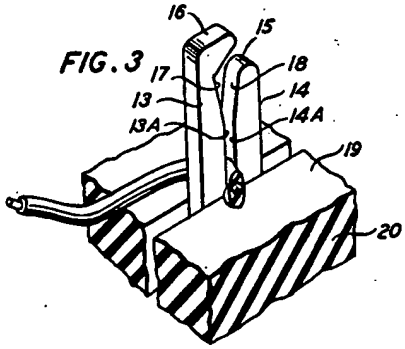


FIG. 3



INVENTORS: W. PFERD
K. H. POHL
D. W. TYLER

BY: John C. Morris

ATTORNEY

United States Patent Office 3,112,147 Patented Nov. 26, 1963

3,112,147

INSULATION CRUSHING SOLID WIRE CLIP TERMINAL

William Pferd, Watchung, Karl-Heinz Pohl, Summit, and Daniel W. Tyler, Middletown, N.J., assignors to Bell Telephone Laboratories Incorporated, New York, N.Y., a corporation of New York

Filed Mar. 26, 1962, Ser. No. 182,560
13 Claims. (Cl. 339—97)

This invention relates to electrical devices for making connections between electrical conductors and more specifically to connectors intended for connecting at least one electrical conductor without first removing the insulation therefrom.

The insulation crushing terminals included in the prior art are of such structure as to necessitate high tolerance specifications and expensive manufacturing processes. In a typical method such terminals are made by first cutting a slot from a piece of metal and then bending the metal in two directions into a bowed configuration with an arcuate cross section, thereby forcing the edges of the slot together to form the insulation crushing edges. In addition to inhibiting mass production processes, high tolerances must be maintained to insure the mating of the edges of the slot at all points, thereby insuring electrical contact between the terminal and a conductor when the latter is forced between the insulation penetrating jaws. The lack of mass production and the demand of high tolerances increase the price of such terminals, making them unattractive to prospective users.

Another method of making the jaws of insulation crushing terminals includes the shearing of a slit in a strip of material by bifurcating the strip so that one furcation is sheared away from the other in such manner that the elastic limit of the sheared material is exceeded. One jaw must then be forced back into juxtaposition with the other, resulting once again in close tolerance demands to insure electrical contact. This method is also limited to thin sectioned metal strips which further limit the size of the conductor that can be used in conjunction with the terminal. Too large a conductor will cause the terminal jaws to fail by excessive yielding, such failure being due to the small cross section of the material and high stress levels induced therein. A further drawback of this method is that upon forcing one jaw back into proximity to the other jaw, high levels of residual stress are induced into the material, adversely affecting electrical properties and resulting in high failure rates due to excessive yielding of the terminal jaws when electrical conductors are forced therebetween.

An object of this invention is to facilitate the connection of insulated wires to apparatus, or to each other, or both.

A more particular object is to connect insulated wires as indicated without first removing the insulation from the wire at the zone of connection.

The novel terminal or connector of this invention is intended for use as a solderless, insulation penetrating terminal to be used in conjunction with insulated electrical conductors and wires.

In accordance with the invention, we have provided a unique structure wherein more than one connection point is provided on each terminal and a multiplicity of terminals can be incorporated into a connecting board, plug or socket to greatly expand the possible number of electrical connections and interconnections which can be made with such a device.

A feature of the invention is the provision of insulation crushing jaws or sheared edges that are effectively in contact with each other at all points when no wire is forced therebetween.

Another feature of the invention is the provision of a hooked receiving passage for temporary placement and holding of electrical conductors before they are forced between the jaws of the insulation crushing terminal.

Another feature of the invention is the provision of a solderless terminal of such novel structure that it may be stamped from a flat sheet of conducting material using well-known mass production processes.

Another feature of the invention is the provision of a terminal and block structure wherein the upper surface of the block may be used as a stop and as a cutting surface for removing excess wire.

Another feature of the invention is the provision of an electrical terminal having a plurality of common connecting points from which connecting boards, plugs, sockets and like devices incorporating numerous terminals can be made for connecting and interconnecting a plurality of electrical conductors.

In accordance with the preferred embodiment of the invention, a flat strip of electrically conducting material is bifurcated from near a free end to a pre-punched elongated slot. This bifurcation is accomplished by shearing the material from one end of the elongated slot to a point adjacent to the free end, being careful in the shearing process not to exceed the elastic limit of the material of the main body of the terminal. Due to such a precaution, when the shearing die is removed or retracted, the one furcation that has been sheared from its mating furcation will return to its exact position before shearing, thereby forming a relatively zero-tolerance slit. The elongated slot near the integral base section provides sufficient deflection of one arm as it is sheared from the other arm to prevent forcing the terminal material near the integral base section into its inelastic range during the shearing process. This method of bifurcation under the elastic limit of the terminal material is made possible by the elongated slot of the structure. When no electrical conductor or wire is forced between the two above-mentioned furcations or jaws, the sheared edges are in intimate contact with each other at all points, thereby insuring good contact when an electrical conductor is forced therebetween.

After shearing of the furcations, other dies cut and form a hooked receiving passage providing a temporary electrical conductor holding structure.

In the invention, the above-mentioned terminals are mounted in an insulating block, the upper surface of the latter being used as a stop to prevent the electrical conductors from being inserted too far into the jaws and therefore into the elongated slot and also to provide an anvil surface against and upon which excess wire may be cut.

The invention will be more clearly understood from the following detailed description, when read in conjunction with the drawing, in which:

FIG. 1 is an elevation view of the terminal showing a plurality of connecting points;

FIG. 2 is an isometric view of a connector incorporating this unique terminal; and

FIG. 3 is an enlarged view of one connecting point of a terminal and the associated mounting.

In the embodiment of the invention as depicted by the various figures, the structure of the terminal comprises a flat sheet of electrically conducting resilient metal such as Phosphor bronze or the like. Near the integral base section 11 of the terminal is an elongated slot 12 from one end of which each connecting point is bifurcated into two arms 13 and 14. The dimensions of the elongated slot 12 are important in that they determine the forces that the furcations will exert against each other to rupture and penetrate the insulation of any electrical conductor that is forced therebetween.

The edges 13A and 14A of arms 13 and 14 are in inti-

mate contact with each other at all points whenever no electrical conductor is forced between them. This is permitted by shearing the edges 13A and 14A without exceeding the elastic limit of the material in the integral base section 11. Due to the elongated slot 12, one furcation may be sheared from the other without exceeding the elastic limit of the integral base section 11 of the terminal. When the shearing die is retracted, the one furcation that was sheared from the other will return to its original position, defining by edges 13A and 14A a relatively zero-tolerance slit.

One arm or furcation has a rounded end 15 and the other arm is longer and has a sidewise protrusion 16 extending partially over the rounded free end 15. The hook or sidewise protrusion 16 forms a short conductor receiving passage and opens into a notch, V-shaped in this instance, which is bounded by the beveled side edges 17 and 18 of the arms 13 and 14. The sidewise protrusion 16 along with the notch formed by the beveled edges 17 and 18 constitutes a receiving passage in which electrical conductors can be temporarily placed and held, as shown in FIG. 2, before they are forced down between the sheared edges 13A and 14A.

Electrical connectors may be made from the terminal by placing a plurality of terminals in a predetermined geometrical pattern in an insulating block 20, as shown in FIG. 2. The upper surface of the block 19 (see FIG. 3) is located intermediate the ends of the sheared slit formed by the edges 13A and 14A. Electrical conductors are then forced between the arms 13 and 14 of the terminal but are prevented by the upper surface 19 of the insulating block 20 from being forced into the elongated slot 12 and therefore losing electrical contact. The upper surface 19 of the insulating block 20 may also be used as an anvil for cutting off excess wire to complete a neat electrical connection, as shown in FIG. 3.

It is obvious that the invention is not limited to the specific structure illustrated and that it may be employed in many ways too numerous to mention by those skilled in the art. However, some of the more obvious ways are tube sockets, plugs and connecting devices. Such use is within the scope of the appended claims.

What is claimed is:

1. An insulation penetrating terminal for insulated electrical conductors comprising a flat sheet of electrically conducting metal bifurcated from adjacent a free end to an integral base section at the other end and having an elongated slot portion, said furcations further having facing beveled side edges near their free ends defining a notch, one furcation having a rounded free end and the other being longer and having a sidewise protrusion extending partially over said rounded free end to define therewith a short conductor receiving passage, one end of said elongated slot portion being joined to said notch by a sheared slit, the latter having opposing edge portions for rupturing the insulation of electrical conductors as they are forced therebetween.

2. An insulation penetrating terminal according to claim 1 wherein said furcations are spaced each from the other in a portion thereof adjacent to the integral base section to define said elongated slot.

3. An insulation penetrating terminal according to claim 1 wherein the notch defined by the facing beveled side edges of the furcations is V-shaped.

4. An insulation penetrating terminal according to claim 1 wherein the short conductor receiving passage opens toward one side of the terminal and also merges into the open end of the notch.

5. An insulation penetrating terminal according to claim 1 wherein the opposing edges of said sheared slit are in intimate contact with each other at all points when no electrical conductor is therebetween.

6. An insulation penetrating terminal for insulated electrical conductors comprising a sheet of electrically conducting metal bifurcated from adjacent a free end to an integral base section at the other end, the furcations being spaced each from the other in a portion thereof adjacent to the integral base section to define an elongated slot portion, said furcations further having facing beveled side edges near their free ends defining a V-shaped notch, said furcations having rounded free ends forming a short conductor receiving passage opening into the open end of the V-shaped notch, one end of said elongated slot portion being joined to said V-shaped notch by a sheared slit, the latter having opposing edge portions for rupturing the insulation of electrical conductors as they are forced therebetween.

7. An insulation penetrating terminal according to claim 6 wherein at least one of said free ends has a sidewise protrusion extending to define a receiving passage, the latter opening toward one side of the terminal and also merging into the open end of the V-shaped notch.

8. An insulation penetrating terminal according to claim 6 wherein said sheet is a flat sheet of electrically conducting metal.

9. A connector for insulated electrical conductors comprising at least one insulation penetrating terminal made of a flat sheet of electrically conducting metal bifurcated from adjacent a free end to an integral base section at the other end, the furcations being spaced each from the other in a portion thereof adjacent to the integral base section to define an elongated slot portion, said furcations further having facing beveled side edges near their free ends defining a V-shaped notch, one furcation having a rounded free end and the other being longer and having a sidewise protrusion extending partially over said rounded free end to define therewith a short conductor receiving passage opening toward one side of the terminal and also merging into the open end of the V-shaped notch, one end of said elongated slot portion being joined to said V-shaped notch by a sheared slit having opposing edge portions for rupturing the insulation of electrical conductors as they are forced therebetween, and a terminal block with said insulation penetrating terminals positioned in the terminal block in a predetermined geometrical pattern.

10. A connector according to claim 9 wherein said terminal block has an upper surface, said insulation penetrating terminals placed in said terminal block in such manner that said upper surface is located intermediate the ends of said sheared slit thereby preventing an electrical conductor from being forced down into the elongated slot portion of the insulation penetrating terminal.

11. A connector according to claim 10 wherein said terminal block is of insulating material for preventing electrical contact between the insulation penetrating terminals.

12. A method for manufacturing insulation penetrating electrical terminals comprising in step by step progression a blanking process wherein the rough outside shape of the terminal is formed, a punching process wherein each connecting point of the rough terminal has an elongated slot punched near an integral base section, a shearing process that bifurcates each connecting point on a line from one end of the pre-punched elongated slot to a spot adjacent a free end of the connecting point; and a finishing process wherein the final details of the terminal are completed.

13. A method for manufacturing insulation crushing electrical terminals according to claim 12 wherein the shearing process is completed without exceeding the elastic limit of the terminal material in the integral base section thereby forming a relatively zero-tolerance slit by allowing the sheared furcations to return to their original positions upon extraction of the shearing die.

No references cited.